

Docket No.: 50024-015

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of : Customer Number: 20277
Akiyoshi MIKAMI : Confirmation Number: not yet assigned
Serial No.: not yet assigned : Group Art Unit: not yet assigned
Filed: August 7, 2003 : Examiner: not yet assigned
For: INORGANIC ELECTROLUMINESCENT DEVICE AND METHOD OF
FABRICATING THE SAME

INFORMATION DISCLOSURE STATEMENT

Mail Stop DD
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In accordance with the provisions of 37 C.F.R. 1.56, 1.97 and 1.98, the attention of the Patent and Trademark Office is hereby directed to the documents listed on the attached form PTO-1449. It is respectfully requested that the documents be expressly considered during the prosecution of this application, and that the documents be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

This Information Disclosure Statement is being filed within three months of the U.S. filing date OR before the mailing date of a first Office Action on the merits. No certification or fee is required.

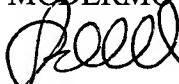
To ensure that these references are available to the Examiner we are providing copies.

Serial No.: not yet assigned

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Respectfully submitted,

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Partial Translation of The extended abstracts of
The 49th Meeting, March 2002 of
The Japan Society of Applied Physics

5 Fabrication of MgS:Eu reddish emitting
electroluminescent devices by rf-sputtering technique

...omitted...

10 [Object] For the object of seeking a novel red
fluorescent thin film suitable for an inorganic EL
emitting layer, a MgS:Eu-based alkaline earth
sulfide-based thin layer was prepared by RF sputtering
to evaluate its crystallinity and luminous
15 characteristics.

[Experimentation and Results] First, MgS:Eu was
selected as a reddish color emitting layer and prepared
by 4"-size RF magnetron sputtering system. The film was
formed at a substrate temperature of 200-300°C in argon
20 gas, through the use of a mixed and annealed powder of
MgS and EuS as a target material. The EL device has a
stacked structure of a MgS:Eu light emitting layer and
a nitride based composite insulating layer. In addition,
after the MgS:Eu film was formed, it was annealed at a
25 temperature of 600°C for one hour in vacuum. Fig. 1 shows

the X-ray diffraction patterns of the MgS:Eu thin film and the source material. With respect to the MgS powder, the diffraction derived from (111), (200), (220) was observed, and the film was strongly orientated to a <100> direction. Fig. 2 shows PL and EL spectra of MgS:Eu film. The peak wavelengths are, in both spectrum, in the range of 590-595nm, where emitted light exhibited reddish orange color. So far, a luminance of $L_{40} = 300\text{cd}/\text{m}^2$ has been obtained by a pulse drive of a frequency of 1 kHz.

10 The luminous characteristics of multiple high-color purity red EL devices will be also reported in the meeting.

...omitted...

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INFORMATION DISCLOSURE CITATION IN AN APPLICATION (PTO-1449)			ATTY. DOCKET NO. 50024-015	SERIAL NO. not yet assigned		
			APPLICANT Akiyoshi MIKAMI			
			FILING DATE August 07, 2003	GROUP not yet assigned		
U.S. PATENT DOCUMENTS						
EXAMINER'S INITIALS	CITE NO.	Document Number Number-Kind Code ₂ (<i>if known</i>)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear		
	US	5,700,591	12/23/1997	Okajima et al.		
	US	4,717,858	01/05/1988	Tanaka et al.		
	US	4,727,004	02/23/1988	Tanaka et al.		
FOREIGN PATENT DOCUMENTS						
EXAMINER'S INITIALS	CITE NO.	Foreign Patent Document Country Codes-Number & Kind Codes (<i>if known</i>)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document Pages, Columns, Lines Where Relevant Figures Appear	Translation	
					Yes	No
		JP 3-266393(counterpart US 5,700,591 listed above)	11/27/1991			
		JP 62-12093(counterpart US 4,717,858 listed above)	01/21/1987			
		JP 62-122096(counterpart US 4,727,004 listed above)	06/03/1987			
		JP 62-225583(counterpart US 4,727,004 listed above)	10/03/1987			
		JP 63-995(counterpart EP 0249942 listed below)	01/05/1988			
		EP 0 249 942(with English abstract is counterpart to JP 63-995 listed above)	12/23/1987	Toyo Soda Manufacturing Co., Ltd.		
		JP 64-027194(with English abstract)	01/30/1989	NEC Corp.	X	
		JP 2001-118677(with English abstract)	04/27/2001	TDK Corp.		
		JP 01-243391(with English abstract)	09/28/1989	Tosoh Corp.		
		JP 02-148595(with English abstract)	06/07/1990	NEC Corp.	X	
		JP 04-094094(with English abstract)	03/26/1992	Tosoh Corp.		
OTHER ART (Including Author, Title, Date, Pertinent Pages, Etc.)						
EXAMINER'S INITIALS	CITE NO.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.				
		Red Electroluminescence from MgS:Eu and Mg _{1-x} Ca _x S:Eu Thin Film Phosphors prepared by RF-Sputtering Technique, Akiyoshi Mikami et al. Ishikawa, Japan, pp. 1 - 3				
		Fabrication of MgS:Eu reddish orange emitting electroluminescent device by rf-sputtering technique, The 49th Meeting, March 2002 of The Japan Society of Applied Physics, (with Translation)				
EXAMINER			DATE CONSIDERED			

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered.
Include copy of this form with next communication to applicant.

1 Applicant's unique citation designation number (optional). 2 Applicant is to place a check mark here if English language Translation is attached.

29p-YF-10

高周波スパッタ法によるMgS:Eu赤色系無機EL素子

Fabrication of MgS:Eu reddish orange emitting electroluminescent devices by rf-sputtering technique

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【目的】無機EL発光層に適した赤色蛍光体薄膜の新規探索¹⁾を目的とし、MgS:Euをベースとしたアルカリ土類硫化物系薄膜を高周波スパッタ法により作製し、結晶性および発光特性について評価した。

【実験および結果】赤色系発光層として、まずMgS:Euを選択し、4" サイズ高周波マグネットロンスパッタ装置より作製した。ターゲット材料にはMgSとEuS粉末を混合および焼成したものを用い、アルゴンガス中、基板温度 200~300°Cで成膜した。EL素子はMgS:Eu発光層と窒化物系複合絶縁層の積層構造とした。なお、MgS:Eu膜は成膜後に600°C、1時間、真空中で熱処理を行った。図1にソース材料とMgS:Eu薄膜のX線回折パターンを示す。MgS粉末は(111)、(200)、(220)からの回折が認められるが、薄膜化により<100>方向に強く配向した。図2にMgS:Eu膜のPLおよびELスペクトルを示す。いずれのスペクトルにおいても、ピーク波長590~595nmの範囲にあり、発光は赤橙色を示した。現状では周波数1kHzのパルス駆動において輝度 $L_{10}=300\text{cd}/\text{m}^2$ が得られている。講演では多元化による高色純度赤色EL素子の発光特性についても報告する。

1) A. Mikami, K. Yamamoto, 'AD/IDW' 01, p.1135 (2001).

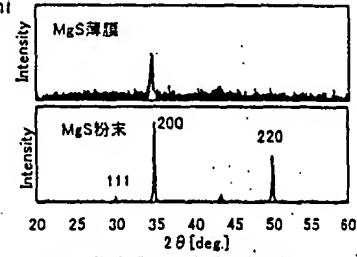


図1 MgS:Eu の X 線回折パターン

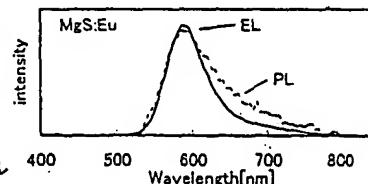


図2 MgS:Eu 膜の PL, EL スペクトル